FOREST CONFLICT IN ASIA: HOW BIG IS THE PROBLEM?

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ACRONYMS AND ABBREVIATIONS

ABiC   Agri-Business Institute, Cambodia

BPS   *Badan Pusat Statistik* (Central Statistics Board)

CIESIN   Center for International Earth Science Information Network

ESRI   Earth System Resources Institute

GIS   Geographic Information System

HH   Household

km   kilometers

MCAFC   Managing Conflict in Asian Forest Communities (USAID project implemented by ARD)

NGO   Nongovernmental Organization

NTFP   Non-timber Forest Product

RGC   Royal Government of Cambodia

SPOT   *Système Pour l'Observation de la Terre* (French remote sensing satellite)

UNDP   United Nations Development Program

USAID   United States Agency for International Development

WRI   World Resources Institute

EXECUTIVE SUMMARY

USAID's Asia and Near East Bureau, working with ARD, Inc., initiated the Managing Conflict in Asian Forest Communities project to analyze the types and causes of forest conflict, identify approaches to reducing conflict, and communicate the seriousness of this problem to governments, the private sector, the donor community, and the US public. This report is part of USAID's effort to conduct a communications campaign, which includes a forest conflict website (see www.forestconflict.com or www.ardinc.com/projects/project.php?area=_Regions&tid=270), presentations at key international fora, publications aimed at general audiences, and a professionally produced video on forest conflict in Asia aimed at a broad media audience.

The **primary purpose of this report** is to provide a sense of the scale of forest conflict in Asia to allow governments of countries in the region, donor organizations, and nongovernment organizations (NGOs) to gauge the relative importance of this issue from the viewpoints of governance, human rights, economic development, poverty reduction, and natural resource management. Disputes over natural resources are common in the rural areas of most developing countries as economies and populations grow. Determining the threshold at which a **dispute** becomes a **conflict** is subjective and depends to a large extent on the circumstances. Many people assume that a conflict must involve violence. The **working definition of conflict** used in this report extends the definition beyond violent confrontation to include situations where people who are dependent on forest resources are restricted from using them to the point of seriously affecting their livelihoods or community social structure. Under this definition, significant livelihood or social impacts resulting from the actions of another party constitute conflict even if the conflict does not lead to violence or a public confrontation between the parties.

There are many approaches that could be used to estimate how many people are affected by forest conflict in Asia, with the costs of analysis rising proportionately as greater accuracy and spatial coverage is sought. We designed the analyses described in this report to arrive at quantitative estimates at the order of magnitude level of accuracy in two countries known to be seriously affected by forest conflict: Indonesia and Cambodia. In both countries, we used available information on forests and their condition and use, along with population data, to estimate the number of people affected by forest conflict. Because Indonesia is a large, archipelagic nation with vast areas of forest, we chose to use remote sensing data and a Geographic Information System (GIS) as the tools of analysis, with deforestation serving as a proxy for conflict. We did not have access to similar GIS data in Cambodia. Because Cambodia is a much smaller country than Indonesia, we were able to calculate the number of people living in or near forests, timber concessions, and protected areas, as well as estimate the number of people dependent on forests for their livelihoods. We used this information to design four approaches to estimate the number of people affected by forest conflict.

Indonesia's extensive and valuable forest resources, large number of forest-dependent people, and history of weak and corrupt forest governance create an environment conducive to forest conflict. Counting the number of people affected by forest conflict would be an impossible task in a country as large and diverse as Indonesia, where communication in remote areas is limited, the affected people have little political voice, and the powerful have an incentive to prevent conflict reporting. A further impediment to quantifying forest conflict is the difficulty of reaching a generally acceptable definition of what constitutes conflict. As it currently stands, incidents of forest conflict become publicly known only when conflict erupts into violence and is reported in the news media. Even then, the full extent of the conflict and number of people affected is not necessarily reported.

In the absence of a practical means with which to conduct a comprehensive, on-the-ground count of the number of people affected by forest conflict in Indonesia, we employ a more easily measured proxy—deforestation—to arrive at an estimate.

The key **assumptions underlying our approach** are that:

- There is a high level of correlation between deforestation and the frequency of forest conflict.

- People living in or around a forest undergoing degradation and deforestation are likely to be adversely affected in terms of their present livelihoods and diminished long-term access to land and water.

- The negative impacts of deforestation are almost certain to cause some level of conflict between forest dwellers and "outsiders" who may be loggers, plantation companies, security forces, or government officials.

- Deforestation impacts on forest people extend beyond deforested areas to adjacent populations who are, to some degree, dependent on forests that are some distance from their homes.

Using a GIS, we analyzed forest change and population data for the entire island of Sumatra, all provinces of Kalimantan (the Indonesian portion of the island of Borneo), the islands that comprise Maluku province, and all of Irian Jaya (the Indonesian portion of the island of New Guinea, currently called Papua). This area includes the 14 Indonesian provinces that contained the bulk of the remaining natural forest cover in the country as of 1990. We calculated the number of people living in forested areas in 1990 that were deforested by 2000, which we consider the minimum population affected by deforestation. This lower estimate of population affected by deforestation and conflict represented 4% of the total population of the 14 provinces (about 2.1 million people). Not surprisingly, fast-developing provinces undergoing widespread logging and forest conversion to plantations (such as those in Sumatra and Kalimantan) have the highest levels of deforestation-affected people, while the still relatively undeveloped and under-populated provinces of Irian Jaya and Maluku had fewer people affected by deforestation/conflict both in relative and absolute terms.

We drew 1-, 2-, and 3-km buffers around the deforested areas and overlaid this area with the population density data, using the GIS to determine the number of people living in each of the buffers. This analysis indicated that the number of people affected by deforestation/conflict ranges from 13.8% (12.3 million people), when a 1-km buffer is used, up to 40% (19.6 million people) of the population in the selected provinces when a 3-km buffer is drawn around each forested area. The figures for individual provinces range from 22% to 60% for a 3-km buffer. **The 40% upper bound estimate of the total population of the 14 selected provinces affected by deforestation/conflict was equivalent to approximately 10% of the entire population of Indonesia at that time.**

The analysis we conducted in Indonesia is a proof-of-concept that this approach can be used to estimate the population affected by deforestation and, by proxy, forest conflict. Confidence in the quantitative accuracy of the results is currently limited by the absence of ground-truthed forest cover data and field-based evidence of the extent of the correlation between deforestation and forest conflict. We are, however, confident that our assumptions are valid as general statements of fact. From the perspective of public policy, this analytical procedure provides valuable insight into the extent of forest conflict in Indonesia, if only at the level of the order of magnitude. **Even at the lower end of the wide range of estimates, we can infer that millions of Indonesians are affected by forest conflict and that it is a public policy concern that deserves the attention of the Indonesian government and the donor community.**

The vast majority of **Cambodians** live in rural areas, earning their livelihoods through agriculture and depending on natural resources for daily needs and as an economic safety net. Indigenous communities living in the forested uplands are almost totally dependent on forest resources and forestland. Resource tenure is still insecure despite initial steps by the Royal Government of Cambodia (RGC) to provide legal guarantees. The current situation of legal uncertainty has encouraged land grabbing by the elites in Cambodian society as well as encroachment on forestland by the landless. Forest and wildlife resources are being lost steadily

through illegal harvesting at a range of scales. These trends are causing conflict between the communities that rely on forestland and forest resources for their livelihoods and the outsiders that are seizing them or using them illegally.

We designed four approaches to estimate the number of Cambodians that experience forest conflict based on either forest dependency, physical proximity to timber concessions and protected areas, or proximity to all forests. These approaches provide a range of estimates of the number of people affected by forest conflict in Cambodia from a low of 550,000 people (if only people who derive the majority of their livelihoods from forests are counted), to over 1.7 million people (when people at lower levels of forest dependency are included or residence in or near forests is the basis for the calculation). Three of the approaches yielded very similar results using different sources of information, indicating that these estimates are probably in the correct order of magnitude. **The highest estimate represents approximately 12% of the population of Cambodia (1.7 million people), and the lowest estimate approximately 4% (550,000 people)**. Our approaches provide no information about the number of people affected by various levels of severity of forest conflict, which can range from minor loss of livelihood resources to armed violence and death. These results do not tell us how the numbers of people affected by forest conflict have changed over the last decade or how the causes and locations of conflict have shifted over this period. We recognize that some percentage of the people who are counted as having been affected by conflict may be encroachers who have actually caused conflict with existing forest inhabitants. Despite these limitations, **our results indicate that a significant number of rural Cambodians are affected by forest conflict.**

1.0   INTRODUCTION

1.1   WHAT IS FOREST CONFLICT?

Disputes over natural resources are common in rural areas in most developing countries as economies and populations grow. Determining the threshold at which a **dispute** becomes a **conflict** is subjective and depends to a large extent on the circumstances. Many people assume that a conflict must involve violence. The **working definition of conflict** used in this report extends the definition beyond violent confrontation to include situations where people who are dependent on forest resources are restricted from using them to the point of seriously affecting their livelihoods or community social structure. Under this definition, significant livelihood or social impacts resulting from the actions of another party constitute conflict even if the conflict does not lead to violence or a public confrontation between the parties.

Conflict over forest resources can occur in many forms and at many levels of severity, affecting communities in different ways. Forest conflict may occur within a forest dwelling community, between adjacent communities, and with outsiders: typically loggers, military and security forces, and agricultural settlers. Forest conflict in the developing countries of Asia is commonly caused by both legal and illegal logging, forest clearance for commercial plantations, and competition over forest resources and forestland among forest inhabitants and newcomers who illegally "grab" land. The nature of forest conflict in the forest-rich countries of Southeast Asia, such as Indonesia, differs greatly from that in the forest-poor countries of South Asia, such as Nepal. The forests of Indonesia are commercially valuable and sparsely populated, while the value of Nepal's forests is primarily as a subsistence livelihood resource for dense rural populations. Failures of governance underlie most serious forest conflict. Governments of forest conflict-affected countries typically fail to establish or enforce just and transparent systems for forest resource allocation and land tenure, throwing these valuable resources up for grabs by both powerful and impoverished people.

1.2   WHY IS IT IMPORTANT?

Incidents of violent conflict over forest resources and forestland are widespread in the developing countries of Asia and are reported in the news media almost daily in some countries. Twelve of the 27 countries in USAID's Asia and the Near East region are known to be affected by forest conflict. American consumers have a direct interest in Asian forest conflict because 30% of the wood products imported into the United States come from Asia. In 2004, these products were valued at $9 billion, the majority of which were in the form of furniture imported from China. A significant portion of the wood used in Chinese-made furniture is sourced from Indonesia, a country where forest conflict is widespread, as indicated in Section 3 of this report.

Forest conflict undermines attempts to improve governance, retards economic development, impoverishes rural people, and impairs key environmental functions. Governments and rebel groups in several Asian countries have used timber to bankroll armed conflict, while lower-level conflict over forests occurs in most of the tropical developing countries of the region. In many of these countries, politicians and security forces harvest timber to get cash to buy political support and fund operations, often using intimidation and violence to overcome resistance from communities that depend on forests for their livelihoods. Unable to protect their forests, these already poor people become further impoverished when they lose access to resources and land.

Politicians and security officials who put their own interests above the welfare of their fellow citizens undermine the legitimacy of the state, create animosity that fuels more violence, and destroy a renewable resource for economic development, all of which contribute to state fragility. Disregard for the rule of law and the human rights of forest communities by government officials creates an atmosphere in which forests and land become open access resources, encouraging behavior that results in conflict.

Forest conflict and forest degradation are two sides of the same coin and lead to broader economic, social, and environmental impacts: governments do not capture revenues from conflict timber; the economic welfare and social structure of forest communities are weakened; and the productivity of forests is reduced. The food security of farmers is threatened when forest degradation changes river flow patterns and increases sediment levels, reducing the effectiveness of irrigation systems. Degraded tropical forests are at increased risk for catastrophic fires that result in conversion to grasslands with limited agricultural or environmental value. The poor logging practices that characterize illegal logging greatly diminish the biodiversity value of forests, which is further reduced when logging crews and security forces poach wildlife and fish.

1.3   USAID'S RESPONSE

USAID's Asia and Near East Bureau, working with ARD, Inc., initiated a project in August 2003 titled **Managing Conflict in Asian Forest Communities (MCAFC)** to analyze the types and causes of forest conflict, identify approaches to reducing conflict, and communicate the seriousness of this problem to governments, the private sector, the donor community, and the US public. This work builds on the findings of a previous USAID project, also implemented with ARD, entitled **Conflict Timber: Dimensions of the Problem in Asia and Africa**. This project identified the extent to which timber is used to finance armed conflict and drive other types of conflict on these two continents and produced a three-volume report that sparked growing interest in forest conflict among policymakers, donor organizations, and nongovernmental organizations (NGOs). The ongoing MCAFC project accomplished the following by the end of 2005:

- **Philippines:** Hosted a major multi-stakeholder workshop in collaboration with USAID/Philippines that developed approaches to reducing natural resource conflict and gained support from key Philippines government agencies.

- **Cambodia:** Conducted a comprehensive assessment of forest conflict, followed by a major multi-stakeholder workshop in collaboration with USAID/Cambodia. Based on workshop recommendations, the project supported two NGOs to build the capacity of forest communities to defend their forest use rights and reduce conflict with illegal loggers and encroachers.

- **Sri Lanka:** Conducted an assessment of watershed-level natural resource conflict in the context of the nation's long-term armed conflict in collaboration with USAID/Sri Lanka.

- **Nepal:** Conducted an assessment to examine the relationship between natural resource conflict and state fragility in collaboration with USAID/Nepal.

- **United States:** Hosted a multi-stakeholder forum in Washington, DC to bring leaders from government, the forest industry, and NGOs together to build partnerships to reduce forest conflict in Asia through both improved governance and greater awareness of wood sourcing policies and procedures.

- **Global:** Conducted a communications campaign including establishing a forest conflict website (see www.forestconflict.com or www.ardinc.com/projects/project.php?area=Regions&tid=270), presentations at key international fora, publications aimed at general audiences, and a professionally produced video on forest conflict in Asia aimed at a broad media audience.

2.0   FOREST CONFLICT QUANTIFICATION

2.1   PURPOSE OF THIS REPORT

The primary purpose of this report is to provide a sense of the scale of forest conflict in Asia to allow governments of countries in the region, donor organizations, and NGOs to gauge the relative importance of this issue from the viewpoints of governance, human rights, economic development, poverty reduction, and natural resource management. When people are briefed on this issue, they typically express concern, and then ask: how many people are affected? This question is difficult to answer because countries do not gather data on forest conflict, the news media typically reports incidents only when serious violence is involved, and the victims of conflict are reluctant or unable to report their own plight due to intimidation or marginalization within their own societies. Despite these obstacles, it is clear that it is necessary to provide insight into the scale of forest conflict as a first step toward devoting political will and resources to reducing the problem.

2.2   OUR APPROACHES TO QUANTIFYING FOREST CONFLICT

There are many approaches that could be used to estimate how many people are affected by forest conflict in Asia, with the costs of analysis rising proportionately as greater accuracy and spatial coverage is sought. We designed the analyses described in the next two sections to arrive at quantitative estimates at the order of magnitude level of accuracy in two countries known to be seriously affected by forest conflict: Indonesia and Cambodia. In both countries, we used available information on forests and their condition and use, along with population data, to estimate the number of people affected by forest conflict. Because Indonesia is a large, archipelagic nation with vast areas of forest, we chose to use remote sensing data and a Geographic Information System (GIS) as the tools of analysis, with deforestation serving as a proxy for conflict. We did not have access to similar GIS data in Cambodia. Because Cambodia is a much smaller country than Indonesia, we were able to calculate the number of people living in or near forests, timber concessions, and protected areas, as well as estimate the number of people dependent on forests for their livelihoods. We used this information to design four approaches to estimate the number of people affected by forest conflict.

2.3   HOW CAN THIS INFORMATION BE USED?

The approaches to quantifying conflict that we used in Indonesia and Cambodia provide wide estimates of the number of people affected by forest conflict, but even at the lower end of these estimates, it is clear that this is a serious issue deserving the attention of the respective governments and the international community. Governments of the two countries can use this as the basis for improving forest governance, with the assistance of donors. The information provided in the following two sections provides insight into the location of areas affected by forest conflict along with the number of people who may be affected. This information can be used as a basis for targeting on-the-ground data collection to verify our estimates and for

designing and targeting donor and NGO programming aimed at reducing and managing conflict. The success of two NGOs, with USAID MCAFC project support, to educate Cambodian forest communities about their forest use rights, indicates that much can be accomplished with modest funding. It is clear that Indonesia and Cambodia are not the only Asian countries that suffer from forest conflict and we hope that this analysis will encourage other countries in the region to investigate the number of their citizens who are affected.

3.0 INDONESIA: ESTIMATING THE NUMBER OF INDONESIANS AFFECTED BY FOREST CONFLICT USING DEFORESTATION AS A PROXY

3.1 CONTEXT AND APPROACH

Factors that Drive Forest Conflict: Indonesia's extensive and valuable forest resources, large number of forest-dependent people, and history of weak and corrupt forest governance create an environment conducive to forest conflict. The following facts support the hypothesis that a significant number of Indonesians are affected by forest conflict, arguably more people than in any other Asian country:

- Indonesia is very populous—with over 240 million citizens—and has a vast, but rapidly dwindling area of valuable tropical forest.

- The remaining extensive blocks of forest are on the large and relatively undeveloped islands of the archipelago. These forests are typically populated by politically marginalized ethnic groups who depend on forest resources and land for their livelihoods.

- Indonesian governments, from colonial times to the present, have looked to forests to provide valuable timber as well as land for resettlement and plantations. During the 32-year New Order regime, forests were used to earn foreign exchange, buy political patronage, fund military operations, and provide illegal income for civil and military officials. A significant portion of the logging was, and continues to be, illegal, and almost all logging fails to meet international environmental and social impact standards.

- Accelerated timber harvesting and forest conversion to agriculture has caused rapid deforestation in recent decades, exacerbated by extensive and recurrent forest fires.

- Timber harvesting and plantation establishment force forest-dwelling Indonesians into conflict with powerful outsiders, negatively affecting their livelihoods, putting their lives at risk, and diminishing their access to land and water. Forest conflict is a fight for survival for many forest dwellers.

- It is difficult for forest dwellers to legally establish and protect their customary forest access rights because allocation of forest resources and land is often driven by corrupt officials acting with impunity in the absence of legally clear, consistent, and just means to assign forest use and ownership rights.

- Deforestation is often a physical symptom of forest conflict, resulting from the combined effects of unclear property rights, weak forest governance, and a rising demand for timber and land.

- Political turmoil and uncoordinated political decentralization efforts, begun in the late 1990s, has accelerated the pace of deforestation.

The Challenge: Counting the number of people affected by forest conflict would be an impossible task in a country as large and diverse as Indonesia, where communication in remote areas is limited, the affected people have little political voice, and the powerful have an incentive to prevent conflict reporting. A further impediment to quantifying forest conflict is the difficulty of reaching a generally acceptable definition of what constitutes conflict. As it currently stands, incidents of forest conflict become publicly known only when conflict erupts into violence and is reported in the news media. Even then, the full extent of the conflict and number of people affected is not necessarily reported. A survey of six regional Indonesian newspapers, conducted over the course of 12 months (March 2002–February 2003), documented 845 separate cases of forest conflict (more than two incidents per day[1]) despite the media's tendency to under-report this type of story.

Our Approach: In the absence of a practical means with which to conduct a comprehensive, on-the-ground count of the number of people affected by forest conflict in Indonesia, we employ a more easily measured proxy—deforestation—to arrive at an estimate.

The key **assumptions underlying our approach** are that:

- There is a high level of correlation between deforestation and the frequency of forest conflict.

- People living in or around a forest undergoing degradation and deforestation are likely to be adversely affected in terms of their present livelihoods and diminished long-term access to land and water.

- The negative impacts of deforestation are almost certain to cause some level of conflict between forest dwellers and "outsiders" who may be loggers, plantation companies, security forces, or government officials.

- Deforestation impacts on forest people extend beyond deforested areas to adjacent populations who are, to some degree, dependent on forests that are some distance from their homes.

Our approach to estimate the population affected by deforestation/conflict consists of the following steps:

- Acquire GIS raster[2] data that indicates changes in forest cover over a specific time period in heavily forested islands of Indonesia.

- Identify those areas that have undergone significant forest loss.

- Identify concentric buffer areas of varying widths around deforested areas.

- Use GIS population data to determine the number of people who lived in the deforested areas and the concentric buffer zones.

Using provincial boundaries and provincial names as they existed in 1990, we analyzed forest change and population data for the entire island of Sumatra, all provinces of Kalimantan (the Indonesian portion of the

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[1]   Conflict Timber: Dimensions of the Problem in Asia and Africa, Volume II, Asian Cases. ARD, Inc. for USAID/OTI and USAID/ANE/TS, Washington, DC.

[2]   A "raster" dataset in a geographic coverage made up of a matrix or grid of equal sized cells or pixels.

island of Borneo), the islands that comprise Maluku province, and all of Iran Jaya (the Indonesian portion of the island of New Guinea, currently called Papua). This area includes the 14 Indonesian provinces (see Table 3.1) that contained the bulk of the remaining natural forest cover in the country as of 1990. The island of Java was omitted, even though serious forest conflict occurs there over its teak plantations; the dense populations in rural Java, coupled with relatively low levels of forest dependency, would have resulted in a significant overestimation of people actually affected by conflict.

3.2 METHODOLOGY

FIGURE 3.1. FOREST CHANGE FROM 1998 TO 2002
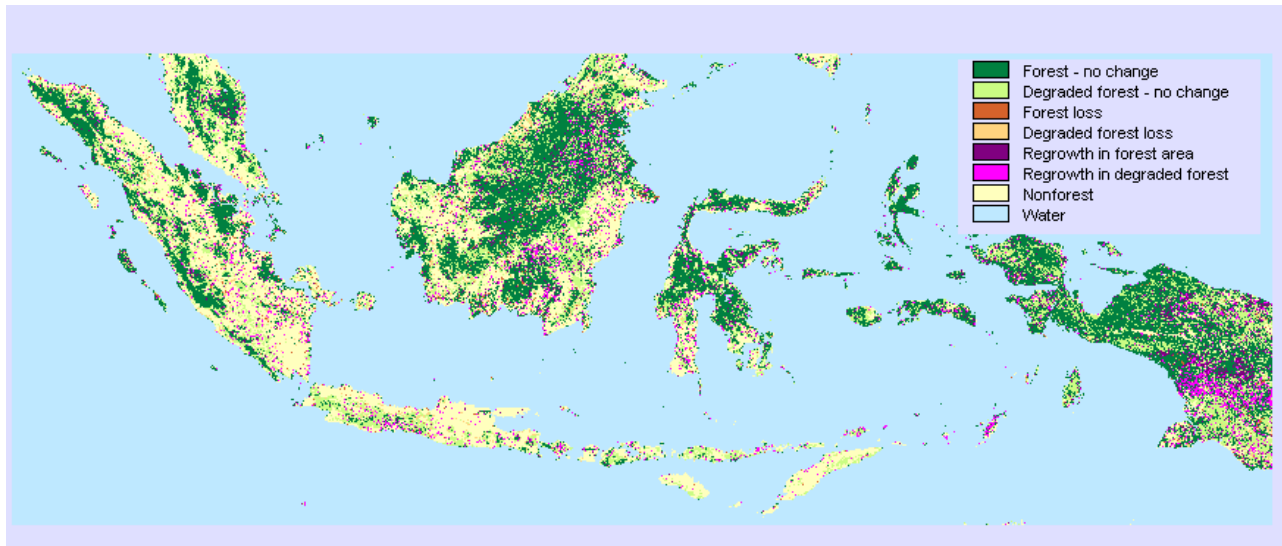
Analysis of Forest Change: The GIS data used in the analysis were provided by the World Resources Institute (WRI), the Center for International Earth Science Information Network (CIESIN), and the Earth System Resources Institute (ESRI). WRI provided GIS data indicating various types of forest cover between 1998 and 2002, in the form of 1 km² grids. These data are based on the classification of SPOT satellite imagery using procedures developed by SarVision at the University of Wageningen in the Netherlands. For all GIS analyses, we used the 1 km x 1 km forest change grid, converting population data to match this grid. The software used to carry out these analyses was Idrisi version 14 (Kilamanjaro) developed by Clark University.

We began the analysis by classifying each pixel (grid cell) into one of the following forest change categories:

- **Forest - no change:** Forest cover with no significant evidence of disturbance by man or fire in either 1998 or 2002. This category includes primary forest and secondary forest that has matured to the stage of having remote sensing characteristics similar to primary forest.

- **Degraded forest - no change:** Forest cover with evidence of disturbance in both 1998 and 2002.

- **Non-forest:** Areas classified as not having forest cover in 1998 with no regrowth by 2002.

- **Forest loss:** Areas classified as "forest" in 1998 and classified as "non-forest" in 2002.

- **Degraded forest loss:** Areas classified as "degraded forest" in 1998 and as "non-forest" in 2002.

- **Regrowth in forest area:** Areas classified as "degraded forest" in 1998 and as "forest" in 2002.

- **Regrowth in degraded forest:** Areas classified as "non-forest" in 1998 and as "degraded forest" in 2002.

- **Water:** Rivers or lakes.

We defined "deforestation" for this analysis to include areas classified as "forest loss" and "degraded forest loss."

## FIGURE 3.2. POPULATION DENSITY IN INHABITANTS PER SQUARE KILOMETER

Source: CIESIN: http://sedac.ciesin.columbia.edu/gpw
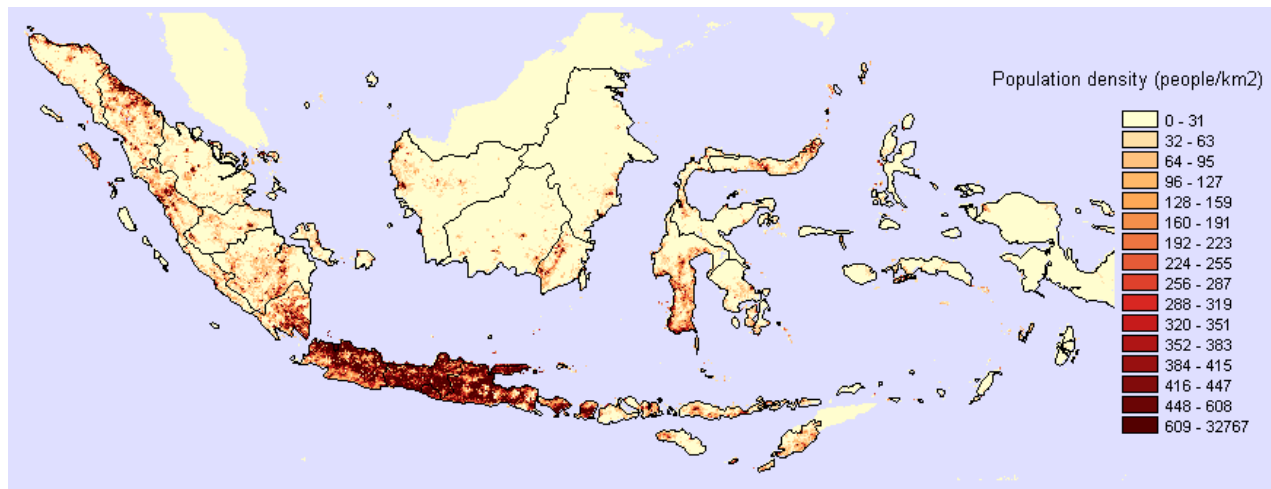
Analysis of Population Distribution: We used CIESIN's 1990 population density data, which have been adjusted to match United Nations population figures, as the basis for the analysis. Each GIS pixel represents the number of inhabitants in the corresponding 1 km² area in 1990. CIESIN also has population density data for 1990, 1995, and 2000. We chose to use the population data for 1990 because it better represents the population historically dependent on the forest than the later population datasets, realizing that population changes would have occurred in virtually all studied areas in the eight years between 1990 and 1998. Census data from 1980 would have been more representative of the distribution of historical forest-dwelling populations, but this data was not available to us as a GIS dataset.

Large-scale migration to Indonesia's remote forest areas took place in the 1970s and 1980s under the government-sponsored Transmigration Program; additional spontaneous migration occurred through the 1990s. Cases of conflict between historical forest dwelling ethnic groups and new settlers are well documented, including prolonged violence that cost thousands of lives in West Kalimantan in the 1990s. New settlers to the forest typically became forest dependent to some degree, putting them at risk to livelihood loss from subsequent agents of deforestation. This role shift muddies the water in terms of who causes conflict and who is impacted by it when the analysis covers a period of decades.

FIGURE 3.3. SELECTED INDONESIAN PROVINCES FOR THIS ANALYSIS
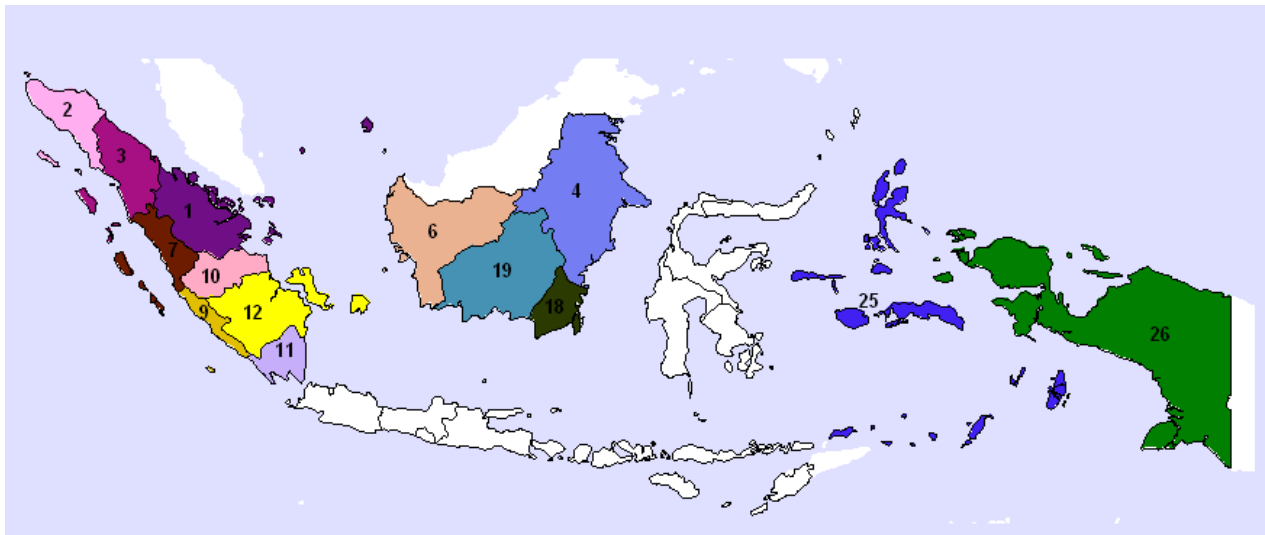
Source: ESRI world administrative unit data, which were rasterized to the match the base grid. The numbers displayed are the province numbers referenced in Table 3.1 and Figure 3.4.

Fourteen of the 26 Indonesian provinces that existed in 1990 were selected for analysis (See Figure 3.3 and Table 3.1), based on the distribution of natural forest at that time.

TABLE 3.1. AREA (KM^2), POPULATION FOR 1990 AND 2000 (x 1000 INHABITANTS) AND ANALYSIS RESULTS FOR THE SELECTED 14 PROVINCES *

Province		Area	Population		Deforestation Population		1 km buffer Population		2 km buffer Population		3 km buffer Population	
ID	Name	km2	1990	2000	Pop	%	Pop	%	Pop	%	Pop	%
1	Riau	96,275	3,304	4,958	133	4.0%	431	13.0%	814	24.6%	1,307	39.6%
2	Aceh	57,555	3,416	3,931	215	6.3%	640	18.7%	1,148	33.6%	1,765	51.7%
3	Sumatera Utara	71,396	10,256	11,650	416	4.1%	1,183	11.5%	2,190	21.3%	3,493	34.1%
4	Kalimantan Timur	197,321	1,877	2,455	44	2.3%	171	9.1%	335	17.9%	573	30.5%
6	Kalimantan Barat	148,043	3,229	4,034	123	3.8%	394	12.2%	753	23.3%	1,230	38.1%
7	Sumatera Barat	43,204	4,000	4,249	321	8.0%	901	22.5%	1,578	39.4%	2,411	60.3%
9	Bengkulu	20,924	1,179	1,567	67	5.7%	198	16.8%	357	30.3%	566	48.0%
10	Jambi	47,029	2,021	2,414	110	5.4%	303	15.0%	538	26.6%	822	40.7%
11	Lampung	34,675	6,018	6,741	149	2.5%	516	8.6%	1,048	17.4%	1,874	31.1%
12	Sumatera Selatan	104,764	6,313	6,900	281	4.5%	908	14.4%	1,735	27.5%	2,767	43.8%
18	Kalimantan Selatan	37,957	2,598	2,985	141	5.4%	524	20.2%	940	36.2%	1,347	51.9%
19	Kalimantan Tengah	156,724	1,396	1,857	70	5.0%	241	17.2%	460	32.9%	725	51.9%
25	Maluku	71,259	1,858	1,206	35	1.9%	126	6.8%	246	13.3%	409	22.0%
26	Irian Jaya	413,020	1,649	2,221	28	1.7%	107	6.5%	224	13.6%	399	24.2%
	Total/Average	1,500,146	49,113	57,168	2,134	4.3%	6,643	13.8%	12,367	25.6%	19,689	40.6%

All population figures are units of 1000 inhabitants and are based on Indonesia's 1990 census *Badan Pusat Statistik* (BPS) Statistics. The percentage figures are the percentage of the total 1990 population for the province.

Calculations and Results: First, we coded as "deforestation" those areas (pixels) classified as either "forest loss" or "degraded forest loss." We then calculated the number of people living in these deforested areas in 1990, which we consider the minimum population affected by deforestation. This lower estimate of population affected by deforestation and conflict represented 4% of the total population of the 14 provinces, ranging from a high of 8% to a low of 1.7% within individual provinces (see Table 3.1). Not surprisingly, fast-developing provinces undergoing widespread logging and forest conversion to plantations (such as those in Sumatra and Kalimantan) have the highest levels of deforestation-affected people, while the still relatively undeveloped and under-populated provinces of Irian Jaya and Maluku had fewer people affected by deforestation/conflict both in relative and absolute terms.

We then drew 1-, 2-, and 3-km buffers around the deforested areas (Figure 3.4 and Figure 3.5) and overlaid this area with the population density data, using the GIS (Figure 3.2) to determine the number of people living in each of the buffers. Table 3.1 presents the results of this analysis, showing that the number of people affected by deforestation/conflict ranges from 4%, when only the deforested areas are included, up to 40% of the population in the selected provinces when a 3-km buffer is drawn around each forested area. The figures for individual provinces range from 22% to 60% for a 3-km buffer, reflecting the same distribution as for the deforested areas alone. **The 40% upper bound estimate of the total population of the 14 selected provinces affected by deforestation/conflict is equivalent to approximately 10% of the entire population of Indonesia at that time.**

FIGURE 3.4. CLASSIFIED COVERAGE OF THE DEFORESTED AREA AND THE 1-, 2-, AND 3-KM BUFFERS
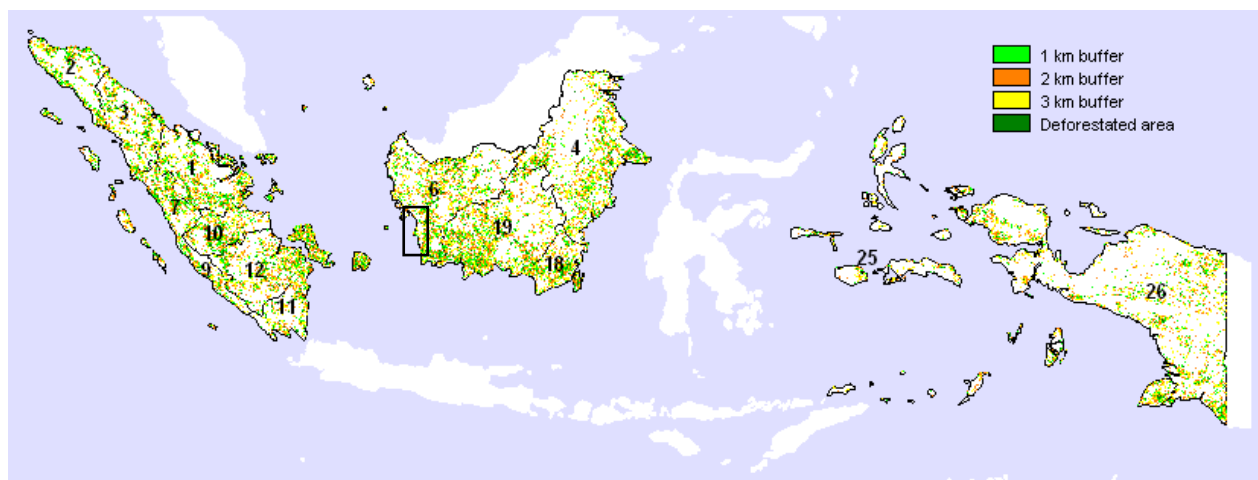
A portion of this area is presented at a larger scale in the following figure.

FIGURE 3.5. CLOSE-UP VIEW OF THE DEFORESTED PIXELS (DARK GREEN) AND THE 1-, 2-, AND 3-KM CONCENTRIC BUFFERS
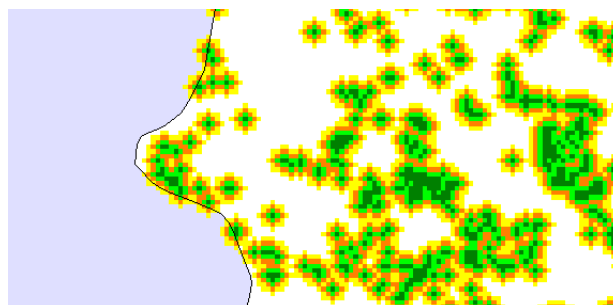
3.3   SOURCES OF ERROR

This analysis is based on a number of broad assumptions and relies on data from several sources that are the result of other data processing operations. These factors can individually or collectively affect the validity of the results. We have identified the following potential sources of error in the analysis:

- **GIS and Data:** Possible data error has a spatial component (i.e., something is not where we think it is) and value component (i.e., it is not what we think it is). Error can also be introduced through converting datasets from one format to another, such as from polygon administrative units to grid (pixel) format. Ideally these errors should be accounted for explicitly and propagated throughout the analysis. By doing this, the output of the analysis would be a range of values or confidence intervals rather than an absolute value. Unfortunately, the error associated with the input datasets was not available and more data would have to be collected to permit a quantification of error. We know that Indonesia has a long history of collecting good statistical information on the country's roughly 78,000 villages and, therefore, the error associated with the population data is considered relatively small. There is potentially significant error in the classification of the forest cover images for both 1998 and 2000. These data have not yet been ground-checked, so we were unable to quantify the errors associated with this data. Spatial error is considered small since the analyses are based on 30m x 30m resolution SPOT imagery that was converted to a 1-km grid.

- **Assumptions:** We cannot be sure about the level of correlation of forest conflict with deforestation. Field observations suggest that the level of correlation is high but on-the-ground studies at sample sites throughout the selected provinces would be required to gain insight into the extent of the correlation. It would be important to learn how the level of forest dependency changes with deforestation and how forest change triggers conflict. The last two decades of the 20th century was a period of rapid demographic and land use change in the most heavily forested parts of Indonesia, resulting in rapid social and economic changes in some places. It is very possible that some forest migrant groups initially caused deforestation/forest conflict and were later impacted by it. Historically, Indonesian forest dwellers frequently engaged in shifting cultivation, causing deforestation. Shifting cultivation usually does not cause conflict at low population densities. Furthermore, its impact has been overwhelmed in Indonesia by other agents of deforestation.

3.4   CONCLUSIONS

From a scientific viewpoint, the analysis presented here is a proof-of-concept that this approach can be used to estimate the population affected by deforestation and, by proxy, forest conflict. Confidence in the quantitative accuracy of the results is currently limited by the absence of ground-truthed forest cover data and field-based evidence of the extent of the correlation between deforestation and forest conflict. We are, however, confident that our assumptions are valid as general statements of fact. From the perspective of public policy, this analytical procedure provides valuable insight into the extent of forest conflict in Indonesia, if only at the level of the order of magnitude. Even at the lower end of the wide range of estimates, we can infer that millions of Indonesians are affected by forest conflict and that it is a public policy concern that deserves the attention of the Indonesian government and the donor community.

4.0 CAMBODIA: ESTIMATING THE NUMBER OF CAMBODIANS AFFECTED BY FOREST CONFLICT USING FOREST DEPENDENCY AND PHYSICAL PROXIMITY TO FOREST AS INDICATORS

4.1 CONTEXT

The vast majority of Cambodians live in rural areas, earning their livelihoods through agriculture and depending on natural resources for daily needs and as an economic safety net. Indigenous communities living in the forested uplands are almost totally dependent on forest resources and forestland. Resource tenure is still insecure despite initial steps by the Royal Government of Cambodia (RGC) to provide legal guarantees. The current situation of legal uncertainty has encouraged land grabbing by the elites in Cambodian society as well as encroachment on forestland by the landless. Forest and wildlife resources are being lost steadily through illegal harvesting at a range of scales. These trends are causing conflict between the communities that rely on land and resources for their livelihoods and the outsiders that are seizing them or using them illegally.

Forest conflict must be viewed within the context of Cambodia's recent history and trends in economic and social conditions in rural areas, including:

- Cambodia's 30-year history of warfare and violence has led to massive displacement of rural people and destruction of property records.

- The majority of Cambodians live in rural areas below or near the poverty line, struggling to earn their livelihoods through subsistence agriculture. A significant proportion of families are landless or nearly so.

- The population is growing rapidly with the age distribution heavily skewed toward children and young adults.

- Weak governance of land and natural resources is exploited by the powerful and politically well connected, who illegally "grab" land and natural resources.

- The forest and land concession systems have thus far failed to meet the real need to use rural land and natural resources to promote economic growth and provide rural jobs. They have instead diminished livelihood options for the rural poor and degraded natural resources while failing to capture economic benefits for the nation.

- Degradation of common or community property resources has weakened the traditional social safety net.

- Most ethnic minority forest communities are unable to defend their land or forest use rights due to their marginal status in Khmer society, widespread illiteracy and poor understanding of the Khmer language, lack of knowledge of the law, and self-perceived powerlessness in the face of the authority figures or outsiders.

- The RGC lacks the political will to guide and control migration to sparsely populated forest areas.

FIGURE 4.1. FORESTED AND SPARSELY POPULATED PROVINCES IN CAMBODIA
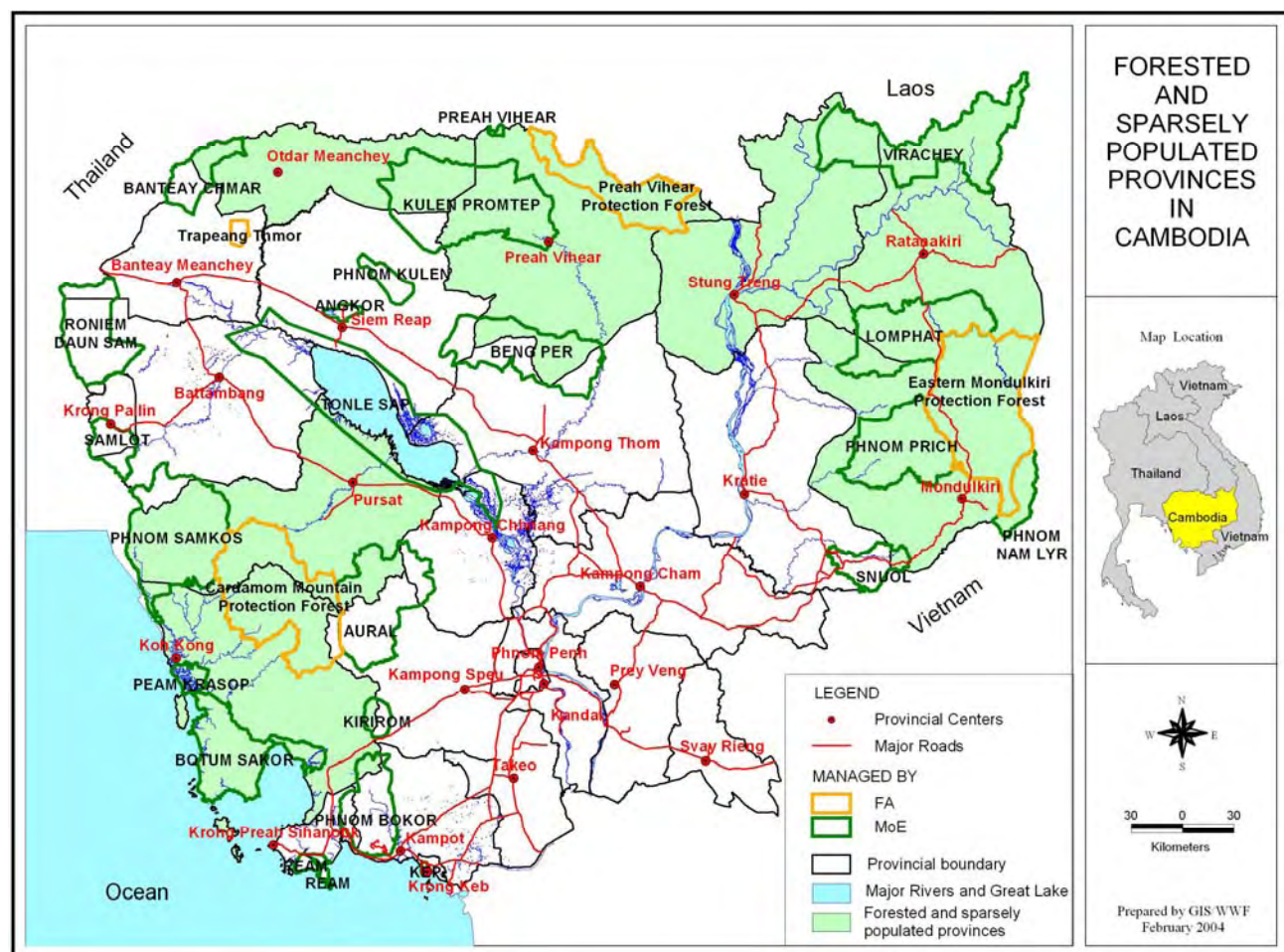
Cambodia is one of the poorest countries in Asia with a per capita gross national income of US $297 and was ranked 130th on the United Nations Development Program's (UNDP) Human Development Index in 2003. Approximately 36% of the population lives below the poverty line. In a nation where 85% of the population

lives in rural areas, with 63% earning their living by subsistence agriculture, more land is needed to accommodate young families each year. The stage is set for forest conflict as population growth, landlessness, and lack of alternative income opportunities are pushing poor people out of the rice-growing lowlands to settle in forest areas, putting them in conflict with indigenous forest communities. Forest communities are also competing for land and resources with land grabbers and land concessionaires, who are also converging on the forest-rich upland provinces.

Sparsely populated, forested uplands are located in the east and north of the country, particularly in the provinces of Mondulkiri, Ratanakiri, Stung Treng, Preah Vihar, and Oddar Meanchay, and in the Cardamom Mountains in the southwest, within Koh Kong and Pursat Provinces (see Figure 4.1). The forested uplands are home to an ethnically diverse group of people, including Khmer and ethnic minorities. As is the case in the lowlands, forest farmers cannot grow enough rice to last the entire year, and usually rely heavily on collection of non-timber forest products (NTFPs) to provide food, building materials, cash to buy rice and other household necessities, and funds to meet family emergencies.

The disparity in population density between the lowlands and forested uplands is stark. For land poor lowlanders, the forested uplands appear to offer a wealth of underutilized land and resources, a view shared by entrepreneurs and the government. Landless lowlanders are attracted to the resource frontier provinces where land and resources are seemingly abundant, putting them into conflict with the people who already live there.

4.2   APPROACH AND METHODOLOGY

The Challenge: Achieving an accurate count of the number of Cambodians affected by forest conflict would be an impossible task because:

- There is no generally accepted definition of forest conflict; and

- Conflict is under-reported and difficult to verify. Affected populations rarely report incidents because they are physically, politically, and linguistically isolated; often intimidated; and usually do not understand their legal rights.

Our Approach and Methodology: In the following four approaches, we use either forest dependency or physical proximity to timber concessions and protected areas as indicators to estimate the number of Cambodians affected by forest conflict. Approach A covers a period of over a decade, from the early 1990s until 2005, during which timber concessions were awarded and protected areas were established in the post-Khmer Rouge period. The other three approaches rely on recent forest dependency and forest cover data. Table 4.1 describes the four approaches we used in terms of methodology, assumptions, results, and sources of error.

TABLE 4.1. DESCRIPTION OF APPROACHES AND RESULTS FOR ESTIMATING THE NUMBER OF CAMBODIANS AFFECTED BY FOREST CONFLICT

Approach	Methodology	Assumptions	Results	Sources of Error
A. Aggregate population of villages inside forest concessions and protected areas	Map concessions and protected areas, identify village locations, and determine aggregate population in these areas and for the sub-set known to have experienced conflict.	Concessions and protected areas cause conflict, affecting all people living in these areas	**1,516,958** total people affected, with **825,893** in known conflict areas	People in these areas are affected at different levels off severity and conflicts happen over years, so there are variations over time and in the degree of conflict
B. Estimate households (HH) that rely heavily on forest products	Use the World Bank estimate that 100,000 HH rely on harvesting resin for bulk of their livelihoods[3] multiplied by an average of 5.5 members in each rural HH.	WB estimate is accurate	**550,000** people affected	1. HH that are less forest dependent but still suffer from conflict not included 2. Average number of members per HH may be inaccurate
C. Estimate households that rely on forest products to some degree for their livelihoods	Compare survey results of 1,200 rural HH done as part of a land study conducted in 4 agro-ecological zones by the Agri-Business Institute Cambodia (ABiC) in 2004 with results of 120 focus group discussions conducted as part of the same study to estimate number of people who are forest dependent nationwide. 12.8% of survey respondents and 28.8% of focus group participants identified themselves as forest dependent. Use these percentages of the rural population to estimate total number of people affected, excluding areas that are not forested.	All forest dependent people suffer some form of forest conflict	Survey: **761,764** people are affected Focus Group: **1,695,855** people affected	1. Errors in survey design or implementation 2. The sampling system is not representative 3. Population data and growth rates may not be accurate
D. Estimate number of people living within 5 km of a forest[4] as an indication of dependency	Calculate 30% of the populations of provinces that have significant areas of forest and where forest conflict has been reported.	All forest dependent people suffer some form of forest conflict. 30% is an accurate estimate of forest dependency	**1,785,384** people affected	1. 30 % may not be an accurate estimate of forest-dependent people 2. Aggregating population at the province level could introduce error

4.3   ASSUMPTIONS AND CONCLUSIONS

Assumptions: We assumed that forest conflict is highly correlated with either living in or near forest concessions or protected areas (Approach A), or being dependent on forest resources for livelihood (Approaches B, C, and D). Approach C relies on self-identification of forest dependency derived from the

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[3]   World Bank. 2004. *Cambodia Rural Sector Strategy Note: Towards a Rural Sector*.

[4]   The Independent Forest Sector Review of Cambodia, conducted in 2004, assumed that people living within 5 km of a forest are dependent on forest resources for at least 10% of their income and that this group constitutes 30% of the population.

results from rural surveys/focus groups. Approaches B and D assume that estimates of forest dependency made by the World Bank and the donor-supported Independent Review of the Forest Sector are realistic.

Conclusions: The results of these approaches provide a range of estimates of the number of people affected by forest conflict in Cambodia from a low of 550,000 people (if only people who derive the majority of their livelihoods from forests are counted), to over 1.7 million people (when people at lower levels of forest dependency are included or residence in or near forests is the basis for the calculation). The results of Approaches A, C, and D yielded very similar results using different sources of information, indicating that these estimates are probably in the correct order of magnitude. **The highest estimate represents approximately 12% of the population of Cambodia, and the lowest estimate approximately 4%**.

Limitations of the Results: Our approaches do not provide any insight into the number of people affected by various levels of severity of forest conflict, which can range from minor loss of livelihood resources to armed violence and death. These results do not tell us how the numbers of people affected by forest conflict have changed over the last decade or how the causes and locations of conflict have shifted over this period. We recognize that some percentage of the people who are counted as having been affected by conflict may be encroachers who have actually caused conflict with existing forest inhabitants.